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Titan Zonal Wind Corroboration via the Huygens DISR Solar Zenith Angle Measurement

M. Allison [1], D.H. Atkinson[2], M.K. Bird[3], M. Tomasko[4]

(1) NASA/GISS; 2880 Broadway; New York, NY 10025 USA.
(2) Dept. of Electrical Engineering; Univ. Idaho; Moscow, ID 83844 USA.
(3) Radioastronomisches Institut, Universität Bonn, Auf dem Hügel 71, 53121 Bonn, Germany
(4) Dept. of Electrical Engineering; Univ. Idaho; Moscow, ID 83844 USA.

email: mallison@giss.nasa.gov

The in situ measurement of the vertical profile of Titan's zonal wind is a major objective of the Huygens probe mission, as specifically addressed by the Doppler Wind Experiment (DWE) described by Bird et al. (2002). It now appears likely that an independent, if somewhat less accurate corroboration of the zonal wind retrieval will be afforded by the measured variation of the solar zenith angle Z from the Huygens Descent Imager/Spectral Radiometer (DISR) throughout the course of the probe atmospheric descent. With a ~250km or ~5.5 wind-borne longitudinal displacement of the probe, as implied by a nominal Titan zonal wind model, and a 10.7 South latitude probe entry on 2005 Jan 14, the solar Z can be expected to vary by some 7 from the time of parachute deployment to touchdown. According to the ground test results presented by Tomasko et al. (2002), the DISR can measure the solar Z to within 0.2, as averaged over the short period oscillations associated with the swing and rotation of the probe. The time-rate-of-change of the measured solar Z to the anticipated accuracy should therefore provide a direct check on the probe-entry wind profile, independent of the relative probe-orbiter geometry. We will present specific numerical examples of the expected range of measurements and wind drift, using an efficient analytic alogorithm for Titan's sub-solar coordinates recently developed by Allison and Ferrier (2003). As with the DWE, the solar Z wind tracking method will admit some ambiguity between longitudinal and latitudinal drift. Fortunately, this ambiguity is less for the currently planned south latitude entry than for the previously considered north equatorial landing site. The analyzed synergism of the DWE and DISR solar-Z measurements should provide an enhanced evaluation of the vertical structure of the Titan atmospheric circulation.

References:

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